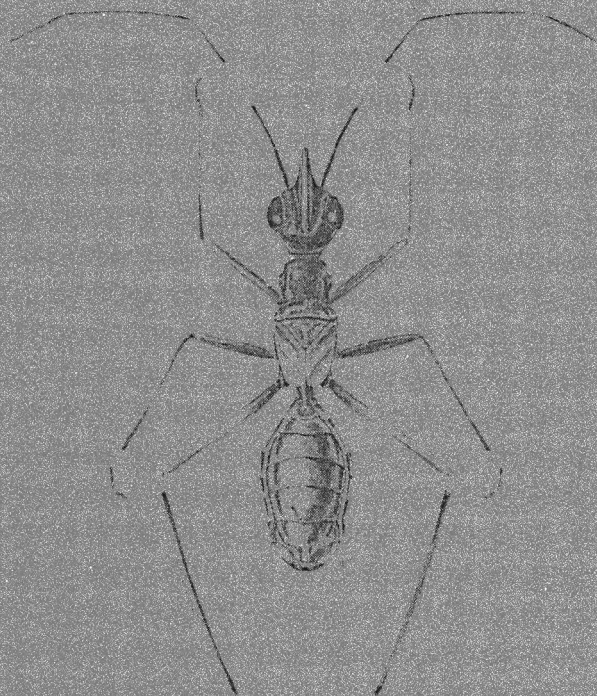


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**Cover:** This undescribed species of *Myrmecoroides* (Heteroptera: Miridae) is about 5 mm in length and occurs along the Great Dividing Range from southeast Queensland to Victoria. It is found on native grasses. The species is sexually dimorphic, with fully-winged males and short-winged females (illustrated here). All species of *Myrmecoroides* are strongly ant-mimetic. This species is being described by Gerry Cassis of the University of New South Wales and Michael Wall of the San Diego Natural History Museum.

*Illustration by Hannah Finlay.*

**A NEW *DEUDORIX* FROM IRIAN JAYA (WEST PAPUA),  
INDONESIA (LEPIDOPTERA, LYCAENIDAE), WITH NOTES ON  
*DEUDORIX EPIRUS* FELDER, 1860**

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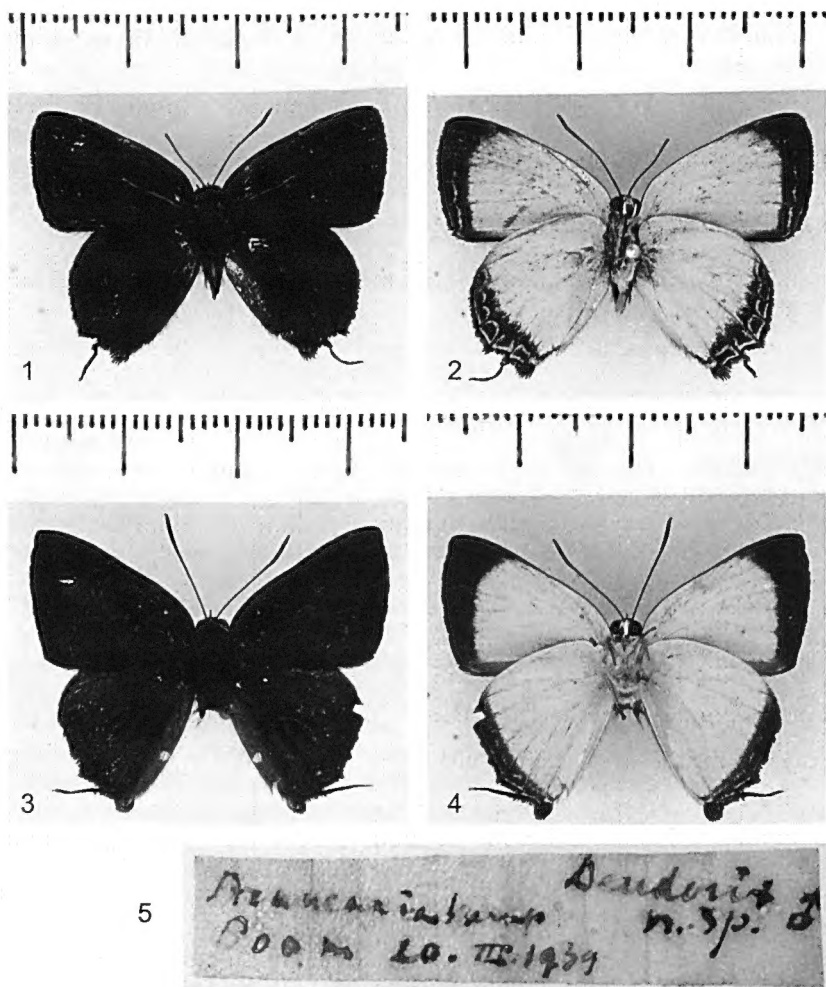
### Abstract

A new and distinctive species of *Deudorix*, *D. toxopeusi* sp. n., from Irian Jaya is described and illustrated. Distribution and nomenclature of geographical races of *D. epirus* Felder, 1860, are discussed; selected taxa are illustrated. The names *agimar* Fruhstorfer, 1908, and *almar* Fruhstorfer, 1908, are synonymised with the name *despoena* Hewitson, 1863

### Introduction

In his *magnum opus* of Papua New Guinea butterflies (PNG), Parsons (1998) set out to provide details and illustrations of each of the butterfly species occurring in PNG. In doing so, he mentioned in passing notable specimens from other islands and regions seen in museums around the world. In an introduction to the genus *Deudorix* Hewitson, 1863, he noted (Parsons, 1998: 403) nine species in PNG, and a further two species from the western half of the island of New Guinea (Indonesia) including "a single male ... of a very distinctive undescribed species" in the collections of Naturalis (Nationaal Natuurhistorisch Museum), Leiden, The Netherlands. Introducing the *epirus* Felder, 1860, species-group, Parsons added "[species of the *epirus* species-group] are characterised by their white or creamy-white, heavily brown-banded undersides. One other distinctive undescribed species (known only by a male from the Snow Mountains of Irian Jaya) may belong in this group as its underside is predominantly white. However, it completely lacks median banding" (Parsons, 1998: 406). The butterfly was not illustrated. It is noted here that the western part of the main island of New Guinea, which belongs politically to Indonesia, is variously referred to in the literature as Irian Jaya, West Irian or West Papua. The name Irian Jaya is used here, other than in direct quotes.

Some years later, Yagishita (2006), described *Deudorix novellus* from five males taken in November 2004 and March 2005 on the island of Morotai, North Maluku, Indonesia. *D. novellus* is an atypical *Deudorix* species, with an unusual underside that is fundamentally creamy-white and unmarked with the exception of a brown border enclosing prominent pale blue markings illustrated here in figs 1, 2 (Yagishita, 2006: pl. 1, figs 9-10). Although Parsons (1998) was included in the references, Yagishita made no reference in the text to Parsons' "Snow Mountains" specimen in Leiden, but did illustrate (Yagishita, 2006: pl. 1, figs 11-12) a female, of which he said "two



**Figs 1-5:** (1) *Deudorix novellus* ♂ upperside (Morotai); (2) ditto, underside; (3) *Deudorix toxopeusi* ♂ upperside (Holotype: Irian Jaya) (4) ditto, underside; (5) ditto, data from glassine envelope.

females of unknown species of Lycaenidae obtained at Timika, Papua state (Irian Jaya) in the mainland New Guinea on September 2001 and on March 2003, have the same pattern on the underside as [*novellus*] ...”.

At much the same time (January 2007), unaware of Yagishita’s slightly earlier paper, the same species was described by Okubu (2007) as *Deudorix detanii* from a solitary male specimen taken on Morotai in April 2006. Okubu



illustrated a specimen similar in all respects to that illustrated by Yagashita (2006). Although he had presumably not seen the Leiden specimen, Okubu (2007: 3) went on to say that Parsons "mentioned an undescribed species of this group from the Snow Mountains of Irian Jaya, and it seems similar to this new species [*detanii* (i.e. *novellus*)], but the two are considered as separate species because of their geographically remote localities".

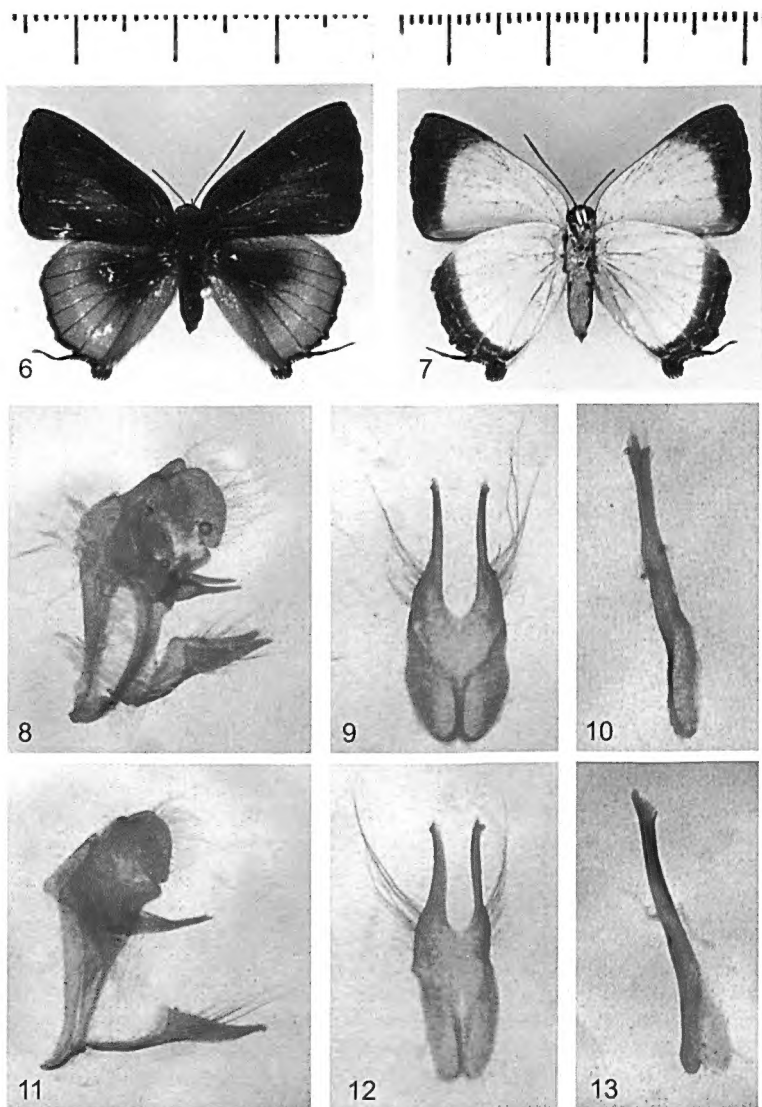
As part of wider ranging research, the first two authors visited Naturalis, Leiden in September 2009, and obtained the specimen mentioned by Parsons (1998) on temporary loan (figs 3, 4). It bears a superficial resemblance to *D. novellus* in the sense that the underside is plain creamy-white with a dark border, but it is clear from its external facies, including the genitalia, that it represents an undescribed species:

***Deudorix toxopeusi* sp. nov.**

(figs 3, 4, 6, 7, 11-13)

*Types.* *Holotype* ♂: INDONESIA, Irian Jaya; two labels: (1) (typed): Neth. Ind.-American New Guinea Exped. / Araucaria Camp / 800m / 20.iii.1939 / L. J. Toxopeus; (2) (handwritten – see fig. 5): Araucaria Camp 800m / 20.iii.1939 / *Deudorix* n. sp. ♂ (Naturalis, Leiden). *Paratypes*: 1♀ Timika, Papua State (Irian Jaya), iii.2003 (BMNH, London); 1♂ Nabire, Weyland, Irian Jaya, xii.2008; 1♀ Timika, Papua State (Irian Jaya), ix.2001 (both coll. Yagashita).

*Description.* Male (Figs 3, 4, 11-13), generally similar to *D. novellus* but wings significantly more acute; forewing length 18mm; appears almost uniform dull purple, but in oblique light upperside forewing dark brown, with shining purplish blue broad median band, reaching inner margin and almost reaching tornus, but not costa (upperside with dark, dull blue median band, discernable in oblique light in *D. novellus*); hindwing similar, blue almost reaching outer margin and tornus, but not inner margin; tornal lobe moderately well developed with distinct pale blue scales enclosing distinct dark spot (tornal lobe less prominent in *D. novellus*); underside similar to *D. novellus*, but with narrower, less decorated dark border; plain creamy-white, forewing with broad brown border, unmarked (border darker brown, enclosing subdued series of submarginal pale markings in *D. novellus*), extending along inner margin; underside hindwing similar, border narrower, enclosing obscure double line of vestigial pale markings (border broader, darker, diffuse along inner margin, pale markings extensive in *D. novellus*); tornal lobe dark chocolate brown, like margin, centred black. Genitalia (figs 11-13) typical *Deudorix*, differing from *D. novellus* (figs 8-10) in having deeply indented posterior dorsal edge to tegumen (shallower in *D. novellus*); prominent angular "step" on posterior edge of vinculum ("rounded" in *D. novellus*); shape of valvae similar to *D. novellus* (and many other *Deudorix* species), but aedeagus proportionally longer than *D. novellus*.



**Figs 6-13:** (6) *Deudorix toxopeusi* ♀ upperside (Paratype: Irian Jaya); (7): ditto, underside; (8) *Deudorix novellus* ♂ genitalia (lateral view); (9): ditto, underside; (10) ditto, aedeagus; (11) *Deudorix toxopeusi* ♂ genitalia (lateral view); (12) ditto, valvae (dorsal view); (13) ditto, aedeagus.

Female (Figs 6, 7) (the female of *D. novellus* is unknown) upperside forewing dark chocolate brown, with obscure golden median patch; upperside hindwing golden brown, darker chocolate brown basally; underside white, tinged cream, with broad grey-brown borders, on forewing unmarked, indistinct pale submarginal line on hw.

*Etymology.* Named in recognition of Lambertus Johannes Toxopeus (1894-1951), the renowned lepidopterist and lycaenid specialist in Dutch colonial times, who collected the holotype. It is interesting that this highly distinctive species seems to have been recognised by Toxopeus (Fig. 5) as a new species of *Deudorix* when it was collected, but that it remained undescribed for a further 70 years, possibly due to the onset of the Second World War.

*Distribution.* Irian Jaya, Indonesia.

#### **A note on *Deudorix epirus* Felder, 1860**

According to Parsons (1998: 406) *D. epirus* (TL: Ambon) is known from a number of localities from the Moluccan islands of Ambon and Seram, through the Kai and Aru island groups to mainland New Guinea and northern Australia. The distribution of subspecies is not entirely clear. D'Abrera (1990: 303) listed six subspecies with the following distribution (misspellings are corrected, and dates of authorship and Type Localities [TL] added):

*D. epirus eos* Hewitson, 1863 [TL: Bacan] (= *tibillus* [*sic* = *tibullus*]) Staudinger, 1888 [TL: Halmahera]. Range: [Bacan].

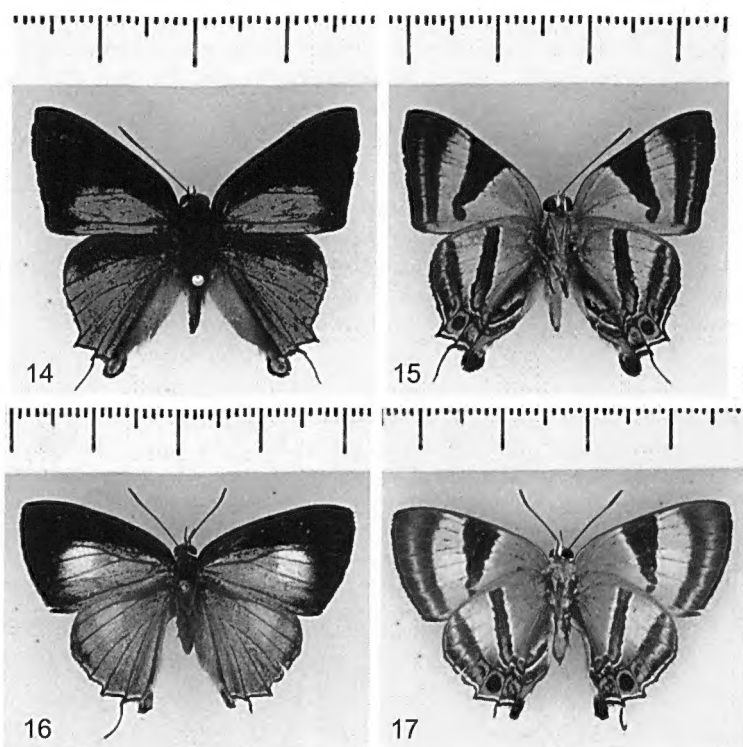
*D. epirus epirus* Felder, 1865 [*recte* = 1860] [TL: Ambon] (= *almar* Fruhstorfer?, 1908 [TL: Astrolabe Bay, Papua New Guinea]). Range: Ambon, Serang [*sic* = Seram], West Irian to Papua, Aru, Kai.

*D. epirus agimar* Fruhstorfer, 1908 [TL: Australia]. Range: Torres Strait. Is., Cape York [Australia].

*D. epirus kallios* [*sic* = *kallias*] Fruhstorfer, 1908 [TL: Fergusson]. Range: Fergusson Is. [D'Entrecasteaux group, Papua New Guinea].

*D. epirus despoena* Hewitson, 1863 [TL: Waigeo]. Range: Waigeo, West Irian, Mioswar I.

Some confusion is evident here. D'Abrera gave the published date of *epirus* as 1865 (no other publication dates were provided) which, if it were so, would give the names *despoena* and *eos* priority. However, the name *epirus* was proposed by Felder in 1860 in an earlier publication (Felder, 1860: 452) to that indicated (Felder & Felder, 1865-1875) by D'Abrera. As Hemming (1935) made clear, pages 18 and 19 of Hewitson's *Illustrations of Diurnal Lepidoptera*, on which *despoena* and *eos* were described, and plate 6, on which they were illustrated, were published in 1863. D'Abrera (1990: 303)



**Figs 14-17:** (14) *Deudorix epirus epirus* ♂ upperside (Ambon); (15) ditto, underside; (16) ditto, ♀ upperside (Ambon); (17) ditto, underside.

illustrated three specimens of *D. epirus*: a ♂ upperside of "*epirus eos*"; both surfaces of a ♀ "*epirus eos*"; and a ♀ upperside of "*epirus epirus*". Accompanying brief text claimed "♂ similar to *eos*" against *D. e. epirus*, *D. e. agimar*, and *D. e. kallias*, and also compared *D. e. despoena* to *D. e. eos*. This comparison is unhelpful: as our illustrations make clear, *D. e. eos* is distinctive and quite different in appearance to any race of *epirus*. It may warrant species status. For the record, it is hardly surprising that Staudinger (1888: pl. 95) described *Sithon tibullus*; the female he examined from Halmahera would have been very unlikely in the late 19<sup>th</sup> century to be obviously associated with the male *Deudorix eos* from Bacan illustrated by Hewitson (1863: pl. 6, figs 8, 9).

The female specimen (no locality data was provided) of nominate *epirus* illustrated by D'Abrera (1990: 303) is heavily suffused with blue, and has

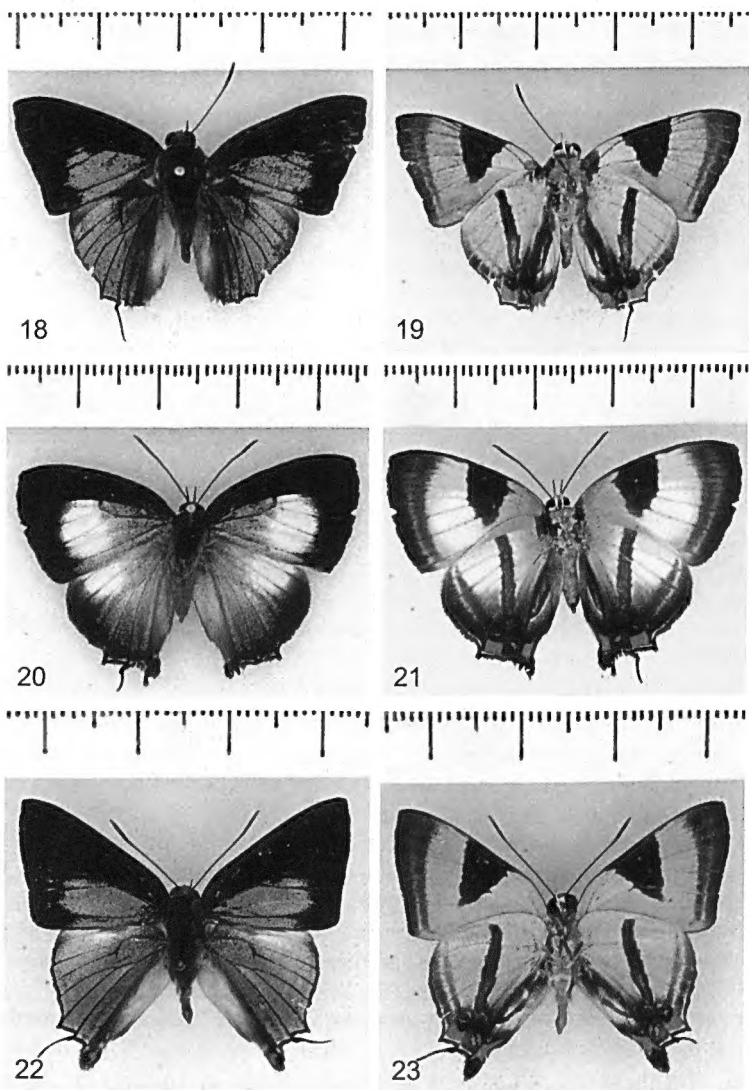


been examined by the authors. It is ex-Felder and almost certainly originated from Ambon. D'Abrera included Aru in the distribution of nominate *epirus*. However, the authors have seen Aru specimens that are indistinguishable from *D. e. agimar* from Australia and females of a short series (1♂, 5♀♀) of *D. epirus* from Aru in the BMNH are variable in terms of overall size and in the degree of orange-yellow wash on the underside (the ♀ illustrated is a large, fresh specimen with a distinct underside yellowish tinge – others seen are almost white). With regard to *D. epirus* from Australia and the main island of New Guinea, Sands & Fenner (1978 : 104) said: “[*D. e. agimar*] was previously known only from far north-eastern Australia, including the Torres Strait islands. We have compared specimens from the Rocky and Claudie Rivers, northern Queensland, with both sexes from southern PNG and found them to be identical. At Lae ... this subspecies overlaps with ssp. *epirus* Felder and intermediate forms occur ...”. Parsons (1998: 406), citing Sands & Fenner’s observation, was of the opinion that “the taxon *agimar* is probably best treated as a synonym of *epirus* ...”.

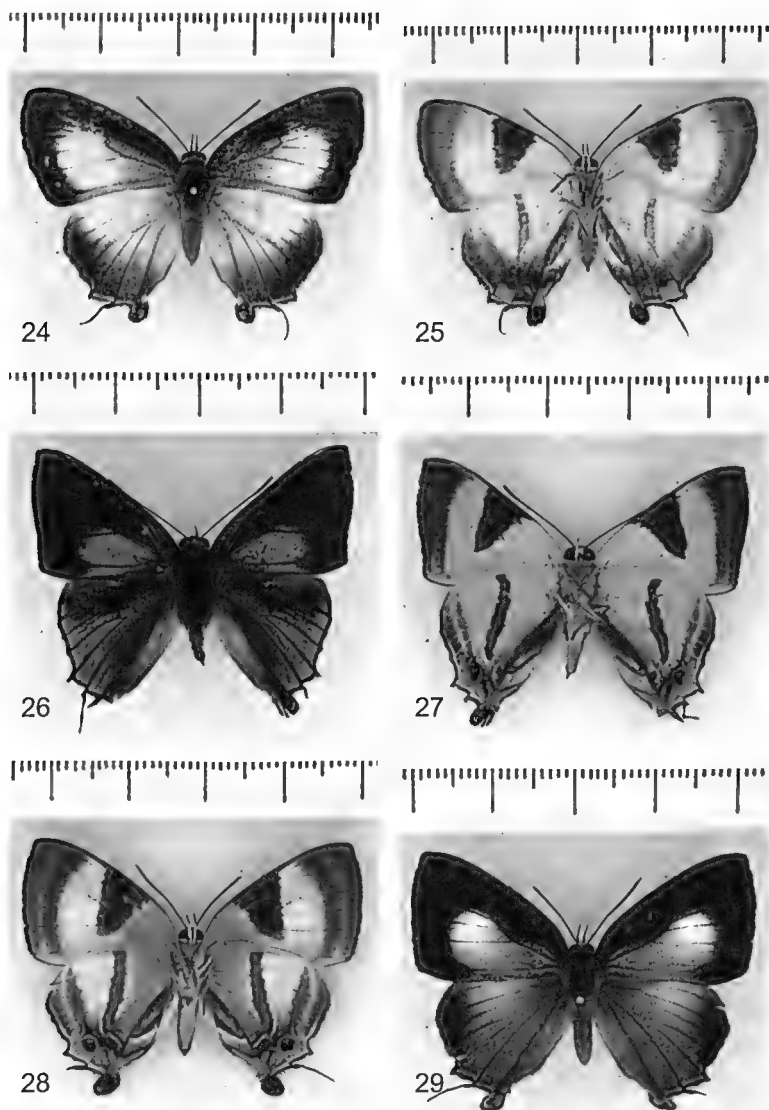
The authors have examined specimens from all parts of the species’ range and – leaving aside the highly distinctive North Moluccan *eos* (= *tibullus*) (Morotai [a new island record], Halmahera, Bacan and Obi) – concluded that although populations at the western and eastern extremities can be assigned with confidence, populations from the central part of the range of *D. epirus* are more problematic. We believe that nominate *epirus* is identifiable and probably restricted to Central Maluku (Ambon, Seram and Saparua); the male is darker blue, with differently shaped underside markings to other races, and the blue of the female is also darker and more extensive.

At the eastern end of the species’ range (the eastern islands of Milne Bay Province, Papua New Guinea) the colour and markings of both sexes of *D. e. kallias* are also distinct, but in what we loosely refer to as the “central” part of the species’ range – Australia, the whole of the main island of New Guinea, and some island groups to the west of New Guinea (including Aru) – we cannot identify constant geographical differences. *D. epirus* is variable, and examination of a long series from a variety of localities throughout New Guinea suggests that they probably represent the same subspecies. This in itself might have some bearing on the uncertainty of other authors (Sands & Fenner, 1978; D'Abrera, 1990; Parsons, 1998) in reaching a consensus in assigning geographical races.

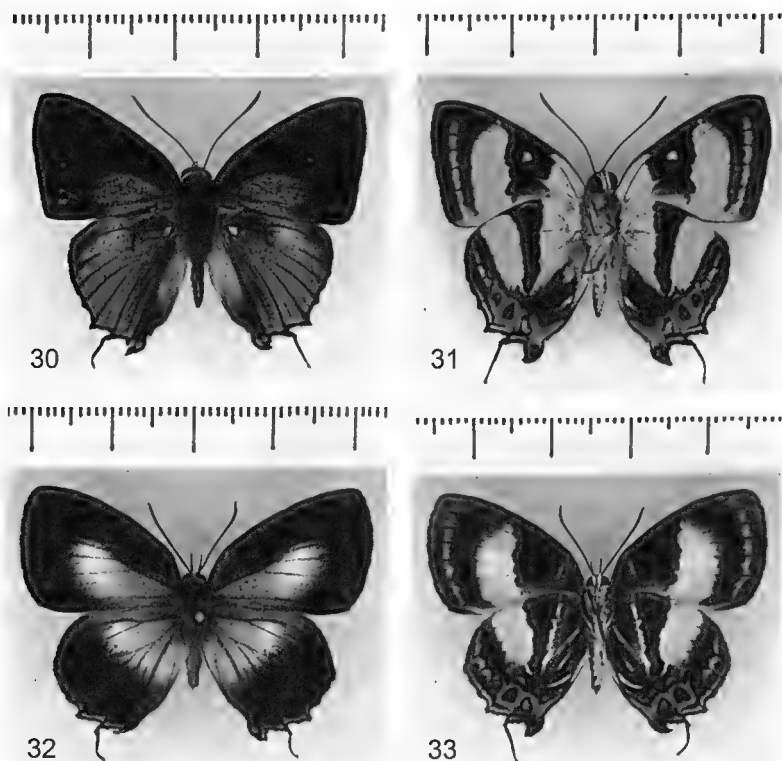
Both D'Abrera (1990) and Parsons (1998) suggested *almar* as a synonym of *epirus*; we believe *almar* is synonymous with the phenotype occurring in New Guinea and Australia. We have examined the type material (1♂, 1♀ labelled Waigiou [sic], Hewitson Coll. 76-69 – figs 12-15) of *D. e. despoena* from Waigeo, and two additional males from that island, and find them indistinguishable from *epirus* from the New Guinea mainland.



**Figs 18-23:** (18) *Deudorix epirus despoena* ♂ upperside (Waigeo) (type ex-Hewitson); (19) ditto, underside; (20) ditto, ♀ upperside (Waigeo) (type ex-Hewitson); (21) ditto, underside; (22) *Deudorix epirus despoena* ♂ upperside (Aru); (23) ditto, underside.



**Figs 24-29:** *Deudorix epirus despoena*, ♀ upperside (Aru); (25) ditto, underside; (26) *Deudorix epirus kallias* ♂ upperside (Kiriwina); (27) ditto, underside; (28) ditto, ♀ upperside (Kiriwina); (29) ditto, uns.



**Figs 30-33:** (30) *Deudorix epirus eos* ♂ upperside (Bacan); (31) ditto, underside; (32) ditto, ♀ upperside (Halmahera); (33) ditto, underside.

Examination of type specimens, and material from a wide range of localities, suggests the following nomenclature and distribution of *Deudorix epirus*, from west to east:

*D. epirus eos* Hewitson, 1863 (TL: Bacan) (= *tibullus* Staudinger, 1888 [TL: Halmahera]) (figs 30-33). Range: the North Moluccan islands of Morotai, Halmahera, Bacan and Obi (Note: may warrant species status).

*D. epirus epirus* Felder, 1860 (TL: Ambon) (figs 14-17). Range: the Central Moluccan islands of Ambon, Seram and Saparua.

*D. epirus despoena* Hewitson, 1863 (TL: Waigeo) (= *agimar* Fruhstorfer, 1908, syn. n. [TL: Australia]; = *almar* Fruhstorfer, 1908, syn. n. [TL: Astrolabe Bay, Papua New Guinea]) (figs 18-25). Range: Aru, Waigeo, mainland New Guinea, including some outlying islands, the Torres Strait Islands and north eastern Australia.

*D. epirus kallias* Fruhstorfer, 1908 (TL: Fergusson) (figs 26-29). Range: the D'Entrecasteaux, Trobriand and Louisiade island groups.

### Acknowledgements

Behnaz van Bekkum-Ansari, Rienk de Jong and Erik van Nieukerken, Naturalis, Leiden, were most helpful and hospitable to the first two authors during a visit to the Museum in September 2009. Erik van Nieukerken also kindly allowed the loan of the unidentified *Deudorix* specimen from Irian Jaya (*Deudorix toxopeusi*). Akira Yagashita, Ibaraki, Japan, provided information and very generously donated the female paratype of *D. toxopeusi* illustrated to the BMNH. Blanca Huertas was helpful during a disruptive time for the BMNH collections.

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## BOOK REVIEW

*Arachnids* by Jan Beccaloni. CSIRO Publishing, 2009. 320 pp. Price \$69.95. ISBN 978 0 643 09697 4

For such a popular group of animals, it is surprising that it has been nearly 50 years since the last general text on arachnids: Theodore Savory's excellent but ageing book remains a useful reference text to this day (Savory 1964). So Jan Beccaloni's lavishly photographed book on the Arachnida is not only a beautifully presented work, but a much needed one too. Each of the 11 Orders of extant taxa of Arachnida are dealt with in turn; beginning with the most familiar group, Araneae (spiders), to the bizarre smaller Orders, like the Palpigradi (micro whip-scorpions) and Solifugae (camel spiders). Each Order receives the same treatment, discussing their diversity, anatomy, and habits, while frequently mentioning examples from the ordinary to the incredible and bizarre. Her style is engaging and enthusiastic, which is also a highlight, because it makes the book accessible to anyone with just a little background in biology.

The chapter on spiders is a fine encapsulation of this most popular group of arachnids and the book is worth it for this alone. However, I admit enjoying the smaller chapters on weirder arachnids more: alien beasts you've probably never seen, except pickled in jars or live in zoos. Reading these chapters recalled a younger passion with science, eagerly seeking and devouring any information on the unusual and bizarre.

The only disappointment is that the chapter on mites and ticks (Acari) contains several errors. There exists within Arachnology a great divide between those that study mites and those who do not, a split exemplified by the *Journal of Arachnology*, which accepts papers on all Arachnida – except mites. One feels that Jan Beccaloni stands on the non-mite side of this divide. Mite morphology is dealt with quite well, but once we move into the world of mite ecology, things get rockier. I can sympathise: mites are so diverse that pinning a generalisation on them is difficult. However, the two major groups of plant parasites, Eriophyoidea and Tetranychoidae, are confused and this is the sort of error a referee should have detected (pp 175, 178). Other errors require more detailed knowledge and in this regard I note two Australian examples. The statement that Lyme disease is in Australia is not true (*Borrelia burgdorferi* has never been detected; Doggett *et al.* 1997); and *Tetranychus desertorum* was never collected from prickly pear in Australia: red mites were observed damaging *Opuntia* and assumed to be this mite without slide-mounting them (Dodd 1929, 1940).

Nevertheless, the fact remains that this is a beautiful piece of work and, for the best part, it is a joy to read and a pleasure to look at. Students and scientists ought to find it a useful text and its gorgeous presentation would make it an excellent gift to anyone desiring a deeper interest in spiders and their kin.

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Owen Seeman, Queensland Museum

# SUPPLEMENTARY ADDITIONS TO A RECENT CLASSIFICATION OF *DACUS* FABRICIUS (DIPTERA: TEPHRITIDAE: DACINAE), WITH NOTES ON THE *D. (NEODACUS) NEWMANI* GROUP

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## Abstract

Seventeen newly described species of Afrotropical *Dacus* Fabricius are placed within a classification proposed for all species. In addition, variation within the species of the *Dacus* (*Neodacus*) *newmani* group in Australia is discussed.

## Introduction

Increasing interest in molecular studies within the genus *Dacus* Fabricius (e.g. Virgilio *et al.* 2009) has demonstrated the continued need for up-to-date morphological classifications with which they can be compared. A recent paper by White and Goodger (2009), describing seventeen new taxa from Africa, appeared too late to be included in the update to the classification of Hancock and Drew (2006) provided by Hancock (2009). Accordingly, this supplement assigns these new species within that classification (Table 1), as an alternative to that of White (2006). It is hoped that further molecular studies will shed light on which, if either, of these current morphological classifications is best supported. Notes on variation within the Australian *Dacus* (*Neodacus*) *newmani* group of species are also provided, and their distributions summarised.

**Table 1.** Placement of newly described Afrotropical species of *Dacus* according to the classification of Hancock and Drew (2006). Note: W & G = White & Goodger.

As currently described	Suggested placement
<i>D. (Ambitidacus) luteovittatus</i> W & G	<i>D. (Dacus) fasciolatus</i> group
<i>D. (Ambitidacus) pseudomirificus</i> W & G	<i>D. (Leptoxyda) mirificus</i> group
<i>D. (Didacus) abruptus</i> W & G	<i>D. (Didacus) ciliatus</i> group
<i>D. (Didacus) albiseta</i> W & G	<i>D. (Psilodacus) mulgens</i> group
<i>D. (Didacus) insolitus</i> W & G	<i>D. (Psilodacus) mulgens</i> group
<i>D. (Leptoxyda) brunnalis</i> W & G	<i>D. (Mictodacus) lounsburyi</i> group
<i>D. (Leptoxyda) velutifrons</i> W & G	<i>D. (Leptoxyda) velutifrons</i> group
<i>D. (Leptoxyda) yaromi</i> W & G	<i>D. (Leptoxyda) eminus</i> group
<i>D. (Lophodacus) acutus</i> W & G	<i>D. (Psilodacus) brevis</i> group
<i>D. (Lophodacus) kurrensis</i> W & G	<i>D. (Psilodacus) binotatus</i> group
<i>D. (Lophodacus) magnificus</i> W & G	<i>D. (Leptoxyda) marshalli</i> group
<i>D. (Lophodacus) pseudapostata</i> W & G	<i>D. (Didacus) scaber</i> group
<i>D. (Lophodacus) senegalensis</i> W & G	<i>D. (Psilodacus) brevis</i> group
<i>D. (Lophodacus) transversalis</i> W & G	<i>D. (Didacus) scaber</i> group
<i>D. (Lophodacus) xanthinus</i> W & G	<i>D. (Psilodacus) brevis</i> group
<i>D. (Psilodacus) kaplanae</i> W & G	<i>D. (Leptoxyda) sphaerostigma</i> group
<i>D. (Psilodacus) vestigivittatus</i> W & G	<i>D. (Mictodacus) langi</i> group

### **The *Dacus* (*Neodacus*) *newmani* group**

This group includes three Australian species (Hancock and Drew 2006): *D. bellulus* Drew & Hancock, *D. newmani* (Perkins) and *D. signatifrons* (May). *Dacus bellulus* is typically a Cape York Peninsula, Torres Strait islands and coastal Northern Territory species with distinct facial spots and no medial postsutural yellow spot on the scutum; however, occasional specimens occur which lack facial spots (e.g. Coen, Pormpuraaw) or have the scutal spot present (e.g. Horn Island). *Dacus newmani* is widespread in semi-arid regions of Australia west of the Great Dividing Range (excluding Cape York Peninsula) and typically has no facial spots and a distinct scutal spot; however, occasional specimens lacking the scutal spot occur (e.g. Blackwater, Qld). *Dacus signatifrons* is a coastal SE Queensland species (known as far north as Maryborough) which typically has a broader costal band, larger facial spots and no scutal spot; however, occasional specimens with a small scutal spot occur (e.g. Brisbane).

Along the east coast of Queensland, from Cairns to Bundaberg, specimens matching both typical *D. bellulus* and typical *D. newmani* occur, together with intermediates (both facial and scutal spots; no or reduced facial spots plus no or vestigial scutal spot), often with all variations occurring at the same locality (e.g. in Mackay). This suggests that a contact or hybrid zone exists along the Queensland coast east of the Great Dividing Range, with the result that specimens from this area cannot be reliably identified.

Specimens examined are in the collections of Queensland Primary Industries and Fisheries (QPIF) or Australian Quarantine and Inspection Service (AQIS), both located in Cairns.

### **Acknowledgements**

I thank Jane Royer (QPIF, Cairns) and Sally Cowan (AQIS, Cairns) for the opportunity to study material in their care.

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## THE FIRST RECORD OF THE FAMILY DOUGLASIIDAE (LEPIDOPTERA) FROM TASMANIA

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### Abstract

The family Douglassiidae is recorded from Tasmania for the first time. The single specimen is the fifth known from Australia and is identified as *Tinagma leucanthus* Meyrick, 1897. The Douglassiidae, both in Australia and overseas, are briefly discussed.

### Introduction

The family Douglassiidae is often placed in the large and cosmopolitan superfamily Tineoidea (Common 1990), which includes the families Psychidae, Tineidae and the Gracillariidae or in the Gracillarioidea (Nielsen 1996). Members of Douglassiidae are easily recognized by the very small size of the adults, the much reduced venation, prominent ocellus, naked proboscis, drooping labial palpi, the smooth-scaled head, lack of an eye-cap and abdominal sternites of the tineoid type.

There are approximately 20 species of the family known from the Palaearctic Region in two genera, *Tinagma* Zeller, 1839 and *Klimeschia* Amsel, 1938 (Gaedike 1974, 1991, Budashkin 2003) and about eight species from the Nearctic, all in *Tinagma* (Gaedike 1990, Harrison 2005). The genus *Protonyctia*, known from Ecuador with the type species *P. originalis* Meyrick, 1932, has been variously placed in the Douglassiidae or the Bucculatricidae. No other species are known besides *Tinagma leucanthus* Meyrick, 1897 from Australia. Currently the world fauna is therefore about 29 species as the Nearctic and Palaearctic have no species in common. Various papers and websites give conflicting information on the number of species and which genera are included in the Douglassiidae, but Davis & Robinson (1999) in the most comprehensive treatment of the family include only the genera *Tinagma* and *Klimeschia*.

No biological information is available from Australia but in Europe Douglassiidae larvae are known to be miners and borers in leaves, petioles or stems of Boraginaceae (*Echium*, *Anchusa*), Rosaceae (*Dryas*, *Fragaria*, *Rubus* and *Potentilla*) and Lamiaceae (*Thymus*). Some species fly at dusk, some in sunlight and some visit flowers. Agassiz (1985) says that the British species rest with the anterior part of the body raised.

### Observations

On 16 January 2006 in still and warm weather conditions, one of us (AK) netted a small moth with a wingspan of 5 mm near Bicheno, Tasmania. It was flying just around sunset in coastal heath and sedgeland close to the coast. It has since proved to be a member of the family Douglassiidae, which



**Figs 1-3.** *T. leucanthes*, male, Bicheno, Tasmania (ANIC): (1) Upperside. (2) Underside. (3) Genitalia, ventral view. a. uncus, b. sacculus, c. valva, d. saccus, e. juxta, f. phallus.

has not been previously recorded in Tasmania. The specimen was conspicuous due to its unusual behaviour and resting posture. It was actively flying, but occasionally rested on sedge leaves. When sitting, it kept the wings in a raised position and frequently moved them up and down. This was reminiscent of the behaviour of some *Choreutis* (Choreutidae) and *Glyphipterix* (Glyphipterigidae) species. The specimen is labelled "Australia, Tasmania, Bicheno, coastal heath/sedge, dusk, leg. A & H Kallies" and has been kindly donated to the Australian National Insect Collection (ANIC), CSIRO, Canberra. The specimen (Figs 1, 2) is a male and in wing pattern and other features closely resembles *Tinagma leucanthes* from Sydney, New South Wales. The ventral surface of the second segment of the labial palpi bears rough scales banded in black and white, the forewing is black with a white median transverse band and a white spot on the costa short of the apex and a smaller corresponding spot near the tornus. The hindwing is black. The upperside of the hindwing looks patterned in the illustration but this is due to scale loss rather than a colour pattern as on the underside of the hind wing. On the underside both forewing and hindwing are black with white banding more extensive than on the upperside. The abdomen is grey with a white tip, with broad reflective scales at the base and on the segmental margins.



### Taxonomic Note

The specimen from Bicheno was dissected by one of us (AK) and the genitalia (Fig. 3) were found to correspond to those illustrated by Common (1990). Thus, we currently consider all known Australian douglasiid specimens to belong to a single species, *T. leucanthes*. Male and female genitalia of Palaearctic *Tinagma* and *Klimeschia* were illustrated by Gaedike (1974, 1991) and Budashkin (2003). While the structures of the male genitalia of *Klimeschia* differ fundamentally from those of *Tinagma*, there are also considerable differences between the Palaearctic *Tinagma* species and the Australian *T. leucanthes*. In *T. leucanthes* the valva shows a very strong basal projection (sacculus) but is otherwise simple with hair-like setae evenly distributed in the distal half. The valvae of Palaearctic *Tinagma* species such as *T. peridecellum* Zeller 1839, the type species of the genus, however, show a less developed sacculus, a conspicuous apical process, a strongly sclerotized ventral margin and the setae appear to be concentrated along the dorsal margin of the valva. In *T. leucanthes* the juxta is very prominent, almost as long as the valva and covered with hair-like setae; in *T. peridecellum*, however, the juxta appears to be relatively small and to lack setae. Furthermore, the aedeagus (phallus) of *T. leucanthes* is only somewhat longer than the valva; that of *T. peridecellum* is about twice as long as the valva. Taken together these differences would suggest that *T. leucanthes* represents a genus different from *Tinagma*; however, lacking knowledge of the female genitalia and sufficient material of typical Palaearctic *Tinagma* species we refrain from the erection of a new genus at this stage.

### Discussion

Douglasiidae are known from very few specimens in Australia. *Tinagma leucanthes*, the only described species, is represented by three syntypes labelled as collected at Sydney by Edward Meyrick on 6 April 1879 and now in the Natural History Museum, London. Meyrick, in his unpublished "diary of captures" (p. 71), records that on 6 April 1879 he collected in Waverley Gully, and that it was hot and sunny with a light SE wind. He collected in the daytime and at light at night. Waverley is now a suburb of east Sydney and has long been cleared for housing. Meyrick did not mention the *T. leucanthes* specimens in his diary, possibly because he was unsure what they were, but they must have come from the general Waverley area. Meyrick collected both sexes and stated that the female differed from the male in that the white spots on the forewing near the apex and tornus were more extensive and there were further white spots and marks in the apical area. The only other specimen in the Douglasiidae known from Australia is a female, identified as *T. leucanthes*, collected by A. Jefferis Turner on [North] Stradbroke Island, Queensland, on 30 November 1902 and now in the ANIC. The Bicheno specimen is larger than the Stradbroke Island specimen but appears to belong to the same species (see above).

Meyrick (1897) described *T. leucanthes* in the family Elachistidae where he (Meyrick 1895) had placed the genus *Tinagma*, possibly on the basis of the reduced venation. This was followed by subsequent authors including Dyar et al. (1902) and Braun (1921) but the genus has none of the characters now used to define the Elachistidae. It was also sometimes placed in the Glyphipterigidae, for example by Staudinger and Rebel (1901), possibly because of the smooth-scaled head, prominent ocellus and naked proboscis. Its odd nature was recognized by Forbes (1923) who used the name Douglassiidae, which was then accepted by Meyrick (1928), Fletcher (1929) and all modern authors. The Douglassiidae differ from the Glyphipterigidae by the reduced venation and the abdominal sternites of the tineoid type. The family has been placed in various superfamilies; the Yponomeutoidea (Common 1970, Heppner & Duckworth 1983) and, after Kyrki (1984) showed it had abdominal sternites of the tineoid type, in the Tineoidea (Common 1990, Nielsen & Common 1991) or the Gracillarioidea (Scoble 1992, Nielsen 1996, Davis & Robinson 1999).

### Acknowledgements

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## BOOK REVIEW

*Identification Guide to the Australian Odonata* by Gunther Theischinger & Ian Endersby. Department of Environment, Climate Change and Water NSW, 2009. iv + 283 pp. ISBN 978 1 74234 475 3

To date, 323 species of Odonata are known from Australia, nearly 6% of the World's fauna. Of these, 82 percent are endemic, with 42 percent of non-endemics shared only with New Guinea. This volume, in A4 format, provides the most comprehensive and up to date summary available for this extraordinary fauna, and is potentially useful to all who study aquatic ecosystems. For the serious student of Australian Odonata it is an essential reference.

The guide consists of clear, well-illustrated and updated dichotomous keys to all species of adults, (similar in general layout to those in the classic, long out of print Watson et al., 1991), comprehensive (as far as possible) keys to larvae, and a detailed atlas of Australian Odonata, with each species represented by a map showing spot records accompanied by brief notes on preferred habitats. Species of conservation concern are discussed in detail.

Readers should understand that the higher classification used is an interpretation of the most recent phylogenetic studies, hence the familiar Protoneuridae disappear into Platynemididae: Disparoneurinae, and the Aeshnidae, Gomphidae and Corduliidae recognised by many authorities are divided into 12 separate families. The continued inclusion of Chlorocyphidae and Calopterygidae in the Australian fauna is almost certainly erroneous.

The book is not commercially available but may be downloaded as a pdf and freely printed, from:

<http://www.environment.nsw.gov.au/resources/publications/09730AustOdonata.pdf>

The authors have noted the following errata:

Page		Should read:
7	<i>Austroaeschna atrata</i> Martin, 1901	<i>Austroaeschna atrata</i> Martin, 1909
7	<i>Austroaeschna hardyi</i> Tillyard 1907	<i>Austroaeschna hardyi</i> Tillyard 1917
9	<i>Lathrocordulia garrisoni</i> Theischinger & Watson, 1978	<i>Lathrocordulia garrisoni</i> Theischinger & Watson, 1991
9	<i>Hemicordulia continentalis</i> Martin, 1901	<i>Hemicordulia continentalis</i> Martin, 1907
9	<i>Hemicordulia kalliste</i> Theischinger & Watson, 1991	<i>Hemicordulia kalliste</i> Theischinger & Watson, 1991
9	<i>Hemicordulia superba</i> Tillyardi, 1911	<i>Hemicordulia superba</i> Tillyard, 1911
10	<i>Aethriamanta nymphaea</i> Lieftinck, 1949	<i>Aethriamanta nymphaeae</i> Lieftinck, 1949
10	<i>Nannophya paulsoni</i> Theischinger 2003	<i>Nannophya paulsoni</i> Theischinger, 2003
10	<i>Notolibellula bicolor</i> Theischinger & Watson 1977	<i>Notolibellula bicolor</i> Theischinger & Watson, 1977
10	<i>Orthetrum villosovittatum</i> (Brauer, 1865).	<i>Orthetrum villosovittatum</i> (Brauer, 1868).

## Reference

WATSON, J.A.L., THEISCHINGER, G. and ABBEY, H.M. 1991. *The Australian Dragonflies.: A Guide to the Identification, Distributions and Habitats of Australian Odonata*. CSIRO, Canberra & Melbourne. vii + 278 pp.

Editor

# LEPIDOPTERA REARED FROM *UROMYCLADIUM TEPPERIANUM* (SACC.) MCALPINE GALLS COLLECTED ON *ACACIA IMPLEXA* BENTH. NEAR CHAFFEY DAM, NEW SOUTH WALES

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## Abstract

Sixteen species of Lepidoptera were reared from *Uromycladium tepperianum* galls collected on *Acacia implexa* from slopes to the north of Chaffey Dam in New South Wales, between August 1993 and April 1997. These galls yielded 733 individuals of Lepidoptera (families Cosmopterigidae, Gelechiidae, Gracillariidae, Oecophoridae, Psychidae, Pyralidae, Tineidae and Tortricidae). Many of the Lepidopteran species in this study appear to be present all year round. Six or seven of the Lepidopteran species found in this study are similar to ones reared from *Acacia* galls in other studies.

## Introduction

*Uromycladium tepperianum* (Sacc.) McAlpine (Uredinales: Pileolariaceae) is a gall-forming rust which has been recorded on over 100 *Acacia* species and *Paraserianthes lophantha* (Willd.) I.C.Nielsen subsp. *lophantha* in Australia (Gathe 1971, Morris 1987). The rust causes galling on stems, branches, phyllodes and reproductive parts, and witches' broom growth at the end of *Acacia implexa* Benth. branches in much the same way as it affects *Acacia saligna* (Labill.) H.L.Wendl. in south-western Australia (Morris 1987). There appear to be a number of genotypes of the rust in Australia and these appear to be restricted to particular host species (Morris 1987). For this reason a genotype of rust has been used as a biological control agent for *A. saligna* in South Africa (Morris 1991, 1997, Wood and Morris 2007), although there has been debate about whether this *Acacia* should be controlled in all situations (Selincourt 1992).

Lepidoptera have been reared from *U. tepperianum* galls in the past (New 1982; Common 1990; Bashford 2002) and it has been suggested that tunnelling by Lepidoptera may prematurely kill galls (New 1982). Extensive studies on moths from *U. tepperianum* galls were conducted by New (1982) and Bashford (2002). New (1982) reared 2549 individuals, of seven moth species, from galls on *Acacia decurrens* Willd. collected at La Trobe University, Victoria. Bashford (2002) reared 4366 individuals, of nine moth species, from galls on *Acacia dealbata* Link collected at a number of sites in Tasmania. Moth species found by New (1982) were *Polysoma eumetalla* (Meyrick) (as *Acrocercops eumetalla* (Meyrick)), *Stathmopoda callichrysa* Lower, *S. cephalaea* Meyrick, *Gauna aegusalis* (Walker), an unidentified species of pyralid (Pyralidae, Phycitinae), *Erechthias* sp. nr *mystacinella* (as *Comodica mystacinella* (Walker)) and *Holocola* sp. (*triangulana* group) (as *Eucosma triangulana* (Meyrick)). Moth species found by Bashford (2002) were mostly the same. He found a



*Macrobathra* sp., *P. eumetalla*, *Stathmopoda chalcotypa* Meyrick, *S. cephalaea*, *G. aegusalis*, *Erechthias ancistrosema* Turner, *E. sp. nr mystacinella* (as *E. mystacinella*), *Opogona comptella* (Walker) and *H. sp. triangulana* group (as *H. triangulana*). Another moth species reared from *Uromycladium* galls is *Conopomorpha helioplha* Meyrick (as *Acrocercops helioplha* (Meyrick)) (Common 1990).

In this paper we enumerate moths reared from *U. tepperianum* galls (Fig. 1) collected on *A. implexa* Benth., near Chaffey Dam, between August 1993 and April 1997.



Fig. 1. *Uromycladium tepperianum* galls on *Acacia implexa*, near Chaffey Dam, New South Wales.

### Material and methods

Galls were collected from *A. implexa* trees on slopes of a ridge to the north of Chaffey Dam (31° 20' S 151° 08' E). Collections were made in the middle of each month from August 1993 to August 1994, then at 3 monthly intervals until July 1995 and in April 1997. Varying numbers and sizes of galls were held in clear plastic containers. Ventilation of containers was via a large hole, covered

by fine metal mesh, in the flexible plastic lids of the containers. Containers were held for two months in a room maintained at close to 25°C. All Lepidoptera emerging over this period were identified and numbers of each species recorded. During the last two weeks that the galls were held few moths emerged. After two months gall remains were dried and weighed and total dry weights of galls recorded. Holding larger numbers of galls in individual containers, and recording gall ages, may have been more informative but was beyond the scope of this study.

Voucher specimens of all moths have been lodged at the Australian National Insect Collection, CSIRO Entomology, Canberra, and of *A. implexa* with *U. tepperianum* galls at the NSW Department of Primary Industries Plant Pathogen Herbarium at Orange and at various herbaria (the National Herbarium of New South Wales, Sydney; Australian Botanic Gardens Herbarium, Canberra and the National Herbarium of Victoria, Melbourne). Duplicates of most moth species have also been lodged at the NSW Department of Primary Industries insect collections at Orange and Tamworth. Moth nomenclature in this paper follows Nielsen *et al.* (1996).

## Results

Sixteen species of Lepidoptera were reared from galls. These are listed in Table 1 and 2. There are two *Macrobathra* species (Cosmopterigidae, Cosmopteriginae), one in which males have black sex scales on a white background (*Macrobathra* sp. 1 in this paper) and another without such male sex scales (*Macrobathra* sp. 2 in this paper). A number of parasitoids were reared from galls but these were not retained. Numbers of moths reared from galls therefore only reflects adult emergence and not the number of eggs and larvae of moths present on and in galls.

Numbers of each moth species varied considerably over time and some species were only collected on a few occasions (Table 1). Collections made in the same month but in different years show a lot of variation in proportions of different moth species present.

A comparison between studies by New (1982) and Bashford (2002) and this study is shown in Table 2.

## Discussion

Although fewer moths were reared from galls in this study (733 individuals) compared with those of New (1982) (2549 individuals) and Bashford (2002) (4366 individuals) more species were found and the proportions of various species were markedly different. This study was undertaken more than 700 km north of that conducted by New (1982) and even further north of that conducted by Bashford (2002), and the gall host was also different. The genotypes of the rust in all studies are also likely to be different, as Morris (1987) showed that genotypes of the rust appear to be adapted to particular host species. Latitude, climate, habitat, rust genotype, gall size and

**Table 1.** Number of Lepidoptera reared per 100 gm of *U. tepperianum* galls from *A. implexa* (and total number of moths) collected near Chaffey Dam, New South Wales.

Family Genus & species	1993					1994
	Aug	Sep	Oct	Nov	Dec	Jan
<b>Cosmopterigidae</b>						
<i>?Leptozestis</i> sp.						
<i>Macrobathra</i> sp. 1 <sup>1</sup>	0.8 (1)	0.4 (1)	0.9 (3)	1.0 (4)		
<i>Macrobathra</i> sp. 2 <sup>2</sup>	1.6 (2)		0.3 (1)		0.8 (3)	0.2 (1)
Unknown sp.	4.8 (6)	0.4 (1)	0.9 (3)	0.5 (2)	0.3 (1)	0.5 (3)
<b>Gelechiidae</b>						
<i>Anarsia</i> sp.	0.8 (1)		0.6 (2)	0.7 (3)		0.4 (2)
<b>Gracillariidae</b>						
<i>Polysoma eumetalla</i>			0.3 (1)			
<b>Oecophoridae</b>						
<i>Lichenaula undulatella</i>						
<i>Placosma resumptella</i>		0.4 (1)			0.3 (1)	
<i>Stathmopoda callichrysa</i>	0.8 (1)	0.4 (1)	0.3 (1)	0.7 (3)	2.2 (8)	
Unknown Oecophorinae species						
<b>Psychidae</b>						
Unknown species						
<b>Pyralidae</b>						
<i>Assara proleuca</i>						
<i>Gauna aegusalis</i>				1.7 (7)	0.8 (3)	
<b>Tineidae</b>						
<i>Erechthias</i> sp. nr <i>mystacinella</i>	5.6 (7)	2.1 (5)	0.6 (2)	3.6 (15)	0.6 (2)	
<b>Tortricidae</b>						
<i>Holocola</i> sp. ( <i>triangulana</i> group)	3.2 (4)	0.4 (1)	0.3 (1)	2.9 (12)	2.2 (8)	0.2 (1)
<i>Zomariana doxasticana</i>				0.2 (1)	0.3 (1)	
Dry weight of gall remains (gm)	124	242	340	420	363	570

**Table 1.** continued

1994								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct
								0.1 (1)
								0.1 (1)
0.2 (1)	0.2 (1)	0.3 (1)	0.2 (1)			0.1 (1)		1.5 (2)
0.5 (3)	0.6 (3)		0.2 (1)	0.5 (2)	0.6 (4)	0.9 (7)	1.6 (22)	0.8 (11)
0.4 (2)	0.2 (1)	0.5 (2)	0.7 (3)	1.3 (5)	3 (21)		0.1 (1)	
			0.2 (1)			0.1 (1)		
							0.1 (1)	1.5 (2)
	0.2 (1)		0.5 (2)	1.0 (4)	1.2 (8)	0.9 (7)	2.5 (34)	1.6 (21)
	0.2 (1)							
			1.8 (8)		0.9 (6)		0.2 (3)	0.2 (3)
	0.2 (1)							
	0.4 (2)	0.5 (2)	1.4 (6)		0.7 (5)	1.3 (10)	1.9 (26)	0.8 (10)
0.2 (1)	0.2 (1)	0.3 (1)	0.2 (1)	0.5 (2)	0.5 (3)	1.5 (11)	0.2 (3)	0.1 (1)
570	487	376	441	394	694	748	1357	1311

Table 1. continued

Family <i>Genus &amp; species</i>	1995		1997	
	Jan	Apr	Jan	Apr
<b>Cosmopterigidae</b>				
<i>?Leptozestis</i> sp.				
<i>Macrobathra</i> sp. 1 <sup>1</sup>				
<i>Macrobathra</i> sp. 2 <sup>2</sup>	0.3		0.9	0.1
	(3)		(13)	(1)
Unknown sp.	0.6		1.1	
	(6)		(17)	
<b>Gelechiidae</b>				
<i>Anarsia</i> sp.	0.8	0.1	1.5	0.8
	(8)	(1)	(22)	(11)
<b>Gracillariidae</b>				
<i>Polysoma eumetalla</i>	0.1		1.5	0.1
	(1)		(22)	(2)
<b>Oecophoridae</b>				
<i>Lichenaula undulatella</i>			0.1	
			(1)	
<i>Placosma resumptella</i>				
<i>Stathmopoda callichrysa</i>	1.1		1.4	0.2
	(11)		(21)	(3)
Unknown Oecophorinae species			0.1	
			(2)	
<b>Psychidae</b>				
Unknown species				
<b>Pyalidae</b>				
<i>Assara proleuca</i>	0.5		0.3	0.1
	(5)		(4)	(2)
<i>Gauna aegusalis</i>	1.1		0.1	
	(11)		(1)	
<b>Tineidae</b>				
<i>Erechthias</i> sp. nr	1.6	0.1	0.6	8.4
<i>mystacinella</i>	(16)	(2)	(9)	(117)
<b>Tortricidae</b>				
<i>Holocola</i> sp. ( <i>triangulana</i>	0.2		0.5	0.4
group)	(2)		(7)	(6)
<i>Zomariana doxasticana</i>				
Dry weight of gall remains	997	1362	1500	1392
(gm)				

<sup>1</sup> Male hind wing with black sex scales on white background; larger species than *Macrobathra* sp. 2 (wing length: 0.55-0.9 cm).

<sup>2</sup> Male hind wing without black sex scales; smaller species than *Macrobathra* sp. 1 (wing length: 0.4-0.45 cm).



**Table 2.** A comparison of the number and percentage of moth species reared from *U. tepperianum* galls collected on *A. implexa* near Chaffey Dam, New South Wales, *A. decurrens* at La Trobe University, Bundoora, Victoria and *A. dealbata* in Tasmania.

Family Genus & species	Chaffey Dam		La Trobe University		Tasmania	
	Total	%	Total	%	Total	%
<b>Cosmopterigidae</b>						
? <i>Leptozestis</i> sp.	1	0.1				
<i>Macrobathra</i> sp. 1 <sup>1</sup>	10	1.4				
<i>Macrobathra</i> sp. 2 <sup>2</sup>	30	4.1				
<i>Macrobathra</i> sp. (Tasmania)					3	0.1
Unknown sp.	89	12.1				
<b>Gelechiidae</b>						
<i>Anarsia</i> sp.	83	11.3				
<b>Gracillariidae</b>						
<i>Polysoma eumetalla</i>	28	3.8	155	6.1	44	1.0
<b>Oecophoridae</b>						
<i>Lichenaula undulatella</i>	4	0.5				
<i>Placosma resumptella</i>	2	0.3				
<i>Stathmopoda callichrysa</i>	126	17.2	11	0.4		
<i>S. chalcotypa</i>					3	0.1
<i>S. cephalaea</i>			1042	40.9	1285	29.4
Unknown Oecophorinac sp.	2	0.3				
<b>Psychidae</b>						
Unknown species	1	0.1				
<b>Pyrilidae</b>						
<i>Assara proleuca</i>	31	4.2	61	2.4		
<i>Gauna aegusalis</i>	23	3.1	2	0.1	9	0.2
<b>Tineidae</b>						
<i>Erechthias ancistrosema</i>					12	0.3
<i>Erechthias</i> sp. nr. <i>mystacinella</i> <sup>3</sup>	236	32.2	384	15.1	2487	57.0
<i>Opogona comptella</i>					5	0.1
<b>Tortricidae</b>						
<i>Holocola</i> sp. ( <i>triangulana</i> group) <sup>4</sup>	65	8.9	894	35.1	518	11.9
<i>Zomariana doxastiana</i>	2	0.3				
<b>TOTAL</b>	<b>733</b>		<b>2549</b>		<b>4366</b>	

<sup>1</sup> Male hind wing with black sex scales on white background; larger species than *Macrobathra* sp. 2 (**wing length: 0.55-0.9 cm**).

<sup>2</sup> Male hind wing without black sex scales; smaller species than *Macrobathra* sp. 1 (**wing length: 0.4-0.45 cm**).

<sup>3</sup> Assuming that *Erechthias* sp. nr. *mystacinella* of this study is the same as *Erechthias mystacinella* of Bashford (2002).

<sup>4</sup> Assuming that *Holocola* sp. (*triangulana* group) of this study is the same as *Holocola triangulana* of Bashford (2002).

abundance, and *Acacia* species and abundance, may all play a role in differences between the composition and number of species found in this study and the Victorian and Tasmanian studies.

The most common species in this study were *Erechthias* sp. nr *mystacinella* (32.2%), *S. callichrysa* (17.2%), an unknown cosmopterigid (12.1%) and *Anarsia* sp. (11.3%). A comparison of the species found in this study and in the Victorian (New 1982) and Tasmanian studies (Bashford 2002) is shown in Table 2. The most common species found in the Victorian study were *S. cephalaea* (40.9%), which was not encountered near Chaffey Dam, *Holocola* sp. (*triangulana* group) (35.1%) and *Erechthias* sp. nr *mystacinella* (15.1%). The most common species found in the Tasmanian study were *E. sp. nr mystacinella* (57.0%), *S. cephalaea* (29.4%) and *H. sp. (triangulana group)* (11.9%). Interestingly the three most common species were the same in Victoria and Tasmania. Ten of the species near Chaffey Dam, *?Leptozeitis* sp., two species of *Macrobathra*, the unknown cosmopterigid, *Anarsia* sp., *Lichenaula undulatella* (Walker) (Oecophoridae, Xyloryctinae), *Placosma resumptella* (Walker) (Oecophoridae, Oecophorinae), an unknown oecophorid, an unknown psychid and *Z. doxasticana* were not encountered in the Victorian study or the Tasmanian study although the *Macrobathra* sp. recorded in the Tasmanian study may be the same as one of those found in this study. Prior to this study the host of *P. resumptella* was not known (Common 1994). Other moths reared from *Uromycladum* galls, in this case from *Acacia pyrifolia* DC. from the Pilbara (Western Australia), are *Cryptophlebia* sp. nr *ombrodelta* (Tortricidae) and *Stathmopoda* sp. nr *callichrysa* (Oecophoridae) (E.D. Edwards unpublished). Another *Anarsia* sp., *Anarsia trichodeta* Meyrick has been recorded tunneling in galls on *Acacia harpophylla* F.Muell. ex Benth. in Queensland, and joining phyllodes of *Acacia ligulata* A.Cunn. ex Benth. in Western Australia (Common 1990). The galls referred to on *A. harpophylla* may have been *U. tepperianum* galls but prior to this study there was no definite reference to *Anarsia* species being reared from *U. tepperianum* galls.

New (1982) pointed out that numbers of moths per gall varied considerably and from the large differences in numbers of moths, and the proportions of various species, reared from collections often only one month apart, and for the same month in different years, this would appear to be the case in this study also. The minimum number of moth species reared from galls during any one month was two and the maximum eleven. In only five cases (out of 18) did a single moth species account for more than 40% of the number of moths reared. In April 1997 *Erechthias* sp. nr *mystacinella* accounted for 82%, in September 1993 *Erechthias* sp. nr *mystacinella* accounted for 50%, in January 1994 an unknown cosmopterigid accounted for 43% and in June 1994 *Anarsia* sp. accounted for 44.7% of the total number of Lepidoptera reared for the respective months. On the other occasion, April 1995, only three moths were reared from galls and two were of the same species. This contrasts with Victorian and Tasmanian studies where one moth always accounted for more than 40% of the moths reared.

Many of the moth species in this study appear to be present all year round. This study would suggest that *Macrobathra* sp. 1 is present in collections from late winter to the end of spring. However, as the number of moths reared from galls is low any inference on seasonality should be made with caution.

New (1982) observed that Lepidoptera were the main insects present in galls. Bashford (2002) did not comment on frequencies of Lepidoptera relative to insects of other orders. The study at Chaffey Dam indicated that in this area large numbers of Curculionoidea could also be reared from galls, about one for every two Lepidoptera reared from galls (J.R.Hosking unpublished data).

A number of the *A. implexa* trees in the study area were dead and most of these had large old *U. tepperianum* galls present on them. Damage to galls by tunneling insects may reduce the life of galls but galls still appeared to have an adverse effect on *A. implexa* in this area. A number of *A. implexa* trees with large galls died during the study.

Some of the moth species from this study have only been recorded from *U. tepperianum* galls but studies have not been made in enough detail to know whether some of these insects are restricted to *U. tepperianum* galls. Of the moth species recorded from *U. tepperianum* *P. eumetalla*, *E. sp. nr. mystacinella* [as *E. mustacinella*], *S. cephalaea*, *H. sp. triangulana* group (as *H. triangulana*), *Macrobathra* sp., *G. aegusalis* and *O. comptella* have also been recorded from galls formed by *Trichilogaster acaciaelongifoliae* (Froggatt) (Hymenoptera) on *Acacia longifolia* subsp. *sophorae* (Labill.) Court in Tasmania (Bashford 2004) and *E. sp. nr. mystacinella* [as *E. mustacinella*], *O. comptella*, *P. eumetalla*, *S. chalcotypa* and *Macrobathra* sp. from galls formed by *Cecidomyia acaciaelongifoliae* Skuse (Diptera) on *Acacia melanoxylon* R.Br. in Tasmania (Bashford 2006).

Similar assemblages of moths inhabit galls induced by the host specific rust fungus *Ravenelia macowaniana* Pазsche (Uredinales: Pileolariaceae) on *Vachellia karroo* (Hayne) Banfi & Galasso (as *Acacia karroo* Hayne) in South Africa (McGeoch 1993, McGeoch and Krüger 1994). Microlepidopteran larvae found in the galls were from the families Cosmopterigidae, Gelechiidae, Noctuidae, Oecophoridae, Pyralidae, Tineidae and Tortricidae. All of these families, with the exception of Noctuidae, were present in galls from near Chaffey Dam. No moth species were the same in Australia and South Africa but the genus *Anarsia* occurred in galls in both countries. Investigation of *U. tepperianum* galls in South Africa may show that a number of Lepidoptera found on *R. macowaniana* have adapted to *U. tepperianum* galls.

A number of questions arise from a comparison between this study and those of New (1982) and Bashford (2002). Are the differences in the moth species present, and their frequency, a reflection of the latitude, climate, habitat, rust genotype or the *Acacia* species or a combination of these? Further studies are needed to resolve these questions.

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## NOTES ON THE ECOLOGY, PHENOLOGY, AND DISTRIBUTION OF *POLLANISUS EUMETOPUS* TURNER (LEPIDOPTERA: ZYGAENIDAE, PROCRIDINAE, ARTONINI)

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### Abstract

New data are provided on the ecology, phenology and morphology of the zygaenid moth *Pollanisus eumetopus* Turner, 1926. The known distribution of the species is significantly increased. The chaetotaxy of the first instar larva is described and the setal arrangement appears to be characteristic for the Artonini. The larvae possess three anal combs similar to other species of the genus *Pollanisus* and of the tribe Artonini. The presence of a small ball of silk spun on the outside of the cocoon is a character apparently typical of the genus *Pollanisus* but has not been described for other Procridinae. The colour of ocelli, formerly considered an important character for distinguishing species of *Pollanisus*, is variable in dried specimens of *P. eumetopus* and therefore not suitable for species identification.

### Introduction

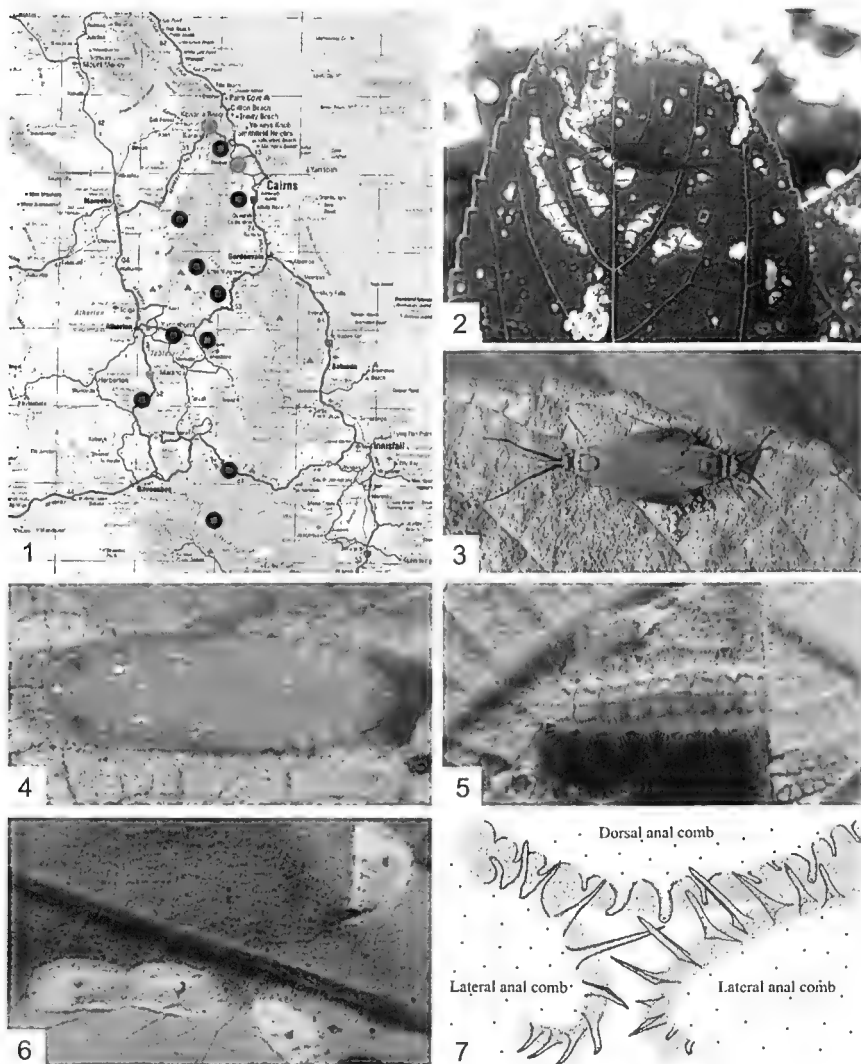
*Pollanisus eumetopus* Turner, 1926 is a localised species, previously known only from the Cairns area, Queensland, Australia, with records from the type locality, Kuranda (Turner, 1926: 443), and Redlynch. Only six males and five females were previously known (Tarmann, 2004: 97).

Recently, the senior author discovered a series of new populations (Fig. 1) by actively searching the host-plant, *Pipturus argenteus* (G. Forster) Wedd. (Urticaceae) (Fig. 2), thus extending the known distribution of *P. eumetopus* significantly further south. Locality data are presented for each new population and the life history stages observed on the host plant are noted. So far, *Pollanisus eumetopus* is the only Zygaenidae known to feed on the Urticaceae. Other known hostplants of species of *Pollanisus* belong to the Dilleniaceae and Fabaceae.

### Methods

Observations and collections of Zygaenidae were made during the day, mainly within National Parks under a scientific purposes permit WITK05084508 issued to the senior author.

Terminology of the setal arrangement of the first abdominal segment of the first instar larva follows Efetov, Keil, Mollet & Tarmann (2000) and describes the position, number and colour of setae. Abbreviations used in the description are as follows: D (dorsal), SD (subdorsal), L (lateral), *l* (light), *d* (dark).



**Figs 1-7.** Distribution and life history of *Pollanisus eumetopus* from west of Cairns, Qld: (1) Map of known localities ●, new localities ●; (2) larval host plant *Pipturus argenteus* leaves with feeding marks and *P. eumetopus* mating; (3) *P. eumetopus* (X2) mating on the 26.v.2008; (4) pupa, ventral view; (5) final instar larva; (6) cocoons with small ball of spun silk attached to the outside; (7) combination of the three anal combs (X100) of the 4<sup>th</sup> instar larva of *P. eumetopus*.

### Material examined

Barron Gorge National Park, 16°51.132'S 145°38.921'E, 65 m, 10, 26.v.2008, eggs, L4, adults; Road to Lake Morris, 16°55.020'S 145°43.017'E, 150 m, 25/26.v.2008, eggs, L1 to L5, adults; Davies Creek Falls, Dinden National Park, 17°02.139'S 145°36.736'E, 560 m, 19.v.2008, eggs, L1, L2; North Lake Tinaroo 17°08.003'S 145°36.026'E, 730 m, 18.v.2008, L1 to L4; Lake Eacham National Park, 17°17'S 145°37'E, 775 m, 17.v.2008, eggs; L1 to L5; Cathedral Fig Tree National Park, 17°10.654'S 145°36.026'E, 770 m, 18.v.2008, eggs, adults; Curtain Fig Tree National Park, 17°16.825'S 145°34.547'E, 720 m, 19.v.2008, eggs; Mount Hypipamee National Park, 17°25'S 145°09'E, 975 m, 17.v.2008, eggs, L1, L2; Palmerston Hwy, Wooroonooran National Park, 17°34.466'S 145°41.388'E, 650 m, 21.v.2008, eggs, L1 to L4. Misty Mountains, Wooroonooran National Park 17°41.420'S 145°41.732'E, 600 m, 21.v.2008, eggs, L1 to L4, adults.

Specimens are deposited in the collections of the authors with some eventually to be deposited in the Australian National Insect Collection (ANIC).

### Phenology and bionomics

Eggs are laid on the underside of the leaves of *Pipturus argenteus* in small groups and are covered with the abdominal setae of the female. Larvae emerge 10 to 15 days after oviposition. First instar larvae (L1) remain grouped near the eggs and feed on the underside of the leaves producing small holes. From L2 to L7 (final instar) (Fig. 5) the larvae disperse over the leaves, always remaining on the undersides. The larval feeding marks progressively widen and the final result is an almost transparent, skeletonised leaf. Because this was the first record of a zygaenid feeding on Urticaceae, larvae of L1, L2, L6 and L7 instars were offered leaves of two exotic species of species of Urticaceae, *Urtica dioica*. and *Parietaria judaica*. Larvae of L1 and L2 refused *P. judaica* and *U. dioica*; larvae of L6 and L7 refused *P. judaica* but readily accepted *U. dioica* for two days but then died, possibly because of certain urticant constituents of the plant

The full-grown, 7<sup>th</sup> instar larva (length ca. 8 mm) pupates in a flat, tight, semi-stiff, beige cocoon (Fig. 6). The pupa is light brown-yellow colour and 5-7 mm in length (Fig. 4). There is a distinctive, small ball of silk, spun on the outside of the cocoon. The presence of this ball is a character that has not been observed in other Procridinae to date. However, this structure is also present on cocoons of *Pollanisus edwardsi* Tarmann, 2004 and *Pollanisus commoni* Tarmann, 2004 (unpublished data) and was present on all cocoons observed. Adults of *P. eumetopus* emerged about 20 days after construction of the cocoon.

*Pollanisus eumetopus* is a rainforest species. Females fly little and remain mostly on the underside of *Pipturus argenteus* leaves. Males fly during dry periods of the day and were occasionally observed in groups of ten to fifteen individuals flying actively around the top of the hostplant, most likely attracted by pheromones of virgin females positioned on the upper side of the



highest leaves. Mating (Fig. 3) is very rapid and is followed by the almost immediate disappearance of the uncoupled males presumably as the females stop 'calling'. No individuals were seen nectaring.

The simultaneous presence of all life cycle stages of *P. eumetopus*, combined with a known flight period of adults from October until May (Tarmann, 2004: 97) suggest that *P. eumetopus* is a multivoltine species.

### Description of the first instar larva

The L1 is of a cream colour and about 1.2 mm in length. The brown lateral spots on the subdorsal part of the third thoracic segment and on the second and fifth abdominal segments present in the larva of *Pollanisus subdolosus clara* Tarmann, 2004 (Tarmann, 2004: 90, pl. 59, figs 3-5) are absent in *P. eumetopus*.

The setal formula of the first abdominal segment of the first instar larvae is: **D: 1d; SD: 1d, 1l; L: 2l.**

This arrangement appears characteristic of the Artonini and is known for *Levuana iridescens* Bethune-Baker, 1906 (Tothill, Taylor & Paine 1930: 85, fig 20); *Pollanisus viridipulverulenta* (Guérin-Ménéville, 1839) (Tarmann 2004:38, 71, fig 131); *Pollanisus apicalis* (Walker, 1854) (Tarmann 2004:83); *P. subdolosus clara* Tarmann, 2004 (Tarmann 2004: 38, 90, fig 131); *Australartona mirabilis* Tarmann, 2004 (Tarmann 2004: 188); *Clelea esakii* Inoue, 1958 (Efetov 2006: 231, 232, fig 7) and *Artona martini* Efetov, 1997 (Efetov 2008: 102, 103, fig 2).

In Procridinae the structure of the anal comb of the final instar larvae differs between genera and sometimes subgenera (Efetov, 2004: 183). *Pollanisus eumetopus* has a combination of three anal combs, consisting of a larger dorsal comb and two smaller lateral combs (Fig. 7) arranged around the anal orifice. These combs consist of one row of long and stiff spines each with a triangular base. These bases are connected to form a dark sclerotised band. A combination of three anal combs is present in other species of the genus *Pollanisus* (unpublished data) and also in other genera of the tribe Artonini (Tothill, Taylor & Paine 1930:95, figs 39, 40).

### Remarks on adult morphology

Examination of the ocelli of field-collected adults of *P. eumetopus* as well as reared adults shows that their colour is variable. The colour of the ocelli was a character used by Tarmann (2004) to separate *Pollanisus* species. On living specimens the ocelli are black and shiny. Some hours after death they become matt and after desiccation they turn from white to light brown and eventually to black, with some specimens having one black and one white ocellus. As a consequence of this variability, the colour of the ocelli can not be used to separate the species of the genus *Pollanisus*.

## Distribution

The new localities listed here increase the known distribution for *P. eumetopus* by 160 km south of its former recorded range in the Cairns district. As the known distribution of the larval host plant ranges from northern Queensland to northern New South Wales, *P. eumetopus* may be even more widely distributed.

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## UNUSUAL INCIDENCE OF DWARF BUTTERFLIES FOLLOWING PROTRACTED RAINS IN SOUTHERN QUEENSLAND

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### Abstract

In April 2010, unusually large proportions of small individuals were recorded in the following butterfly species: *Papilio aegaeus*, *Tirumala hamata* and *Hypolimnys bolina*. This trend was not evident in *Euploea core*. Starvation following earlier population surges may explain this trend.

### Observations

Following exceptionally heavy rains over southern Queensland in the first three months of 2010, very large numbers of butterflies of many species were present in the Sunshine Coast Area and elsewhere. From the beginning of April, I noticed an unusual number of small individuals in certain species

To quantify this effect, from 21.iv.2010-26.iv.2010, I collected samples of three species: *Papilio aegaeus* Donovan, 1805, *Tirumala hamata* Moore 1880 and *Hypolimnys bolina* (Linnaeus, 1758). During the sampling period virtually every individual which appeared in my garden at Caloundra was captured. The forewing length was measured, the sex noted, and the butterfly was normally marked and released, with some spectacular dwarves being retained. A spectacular dwarf male *T. hamata* is shown for comparison beside a specimen of average size (Fig. 1).

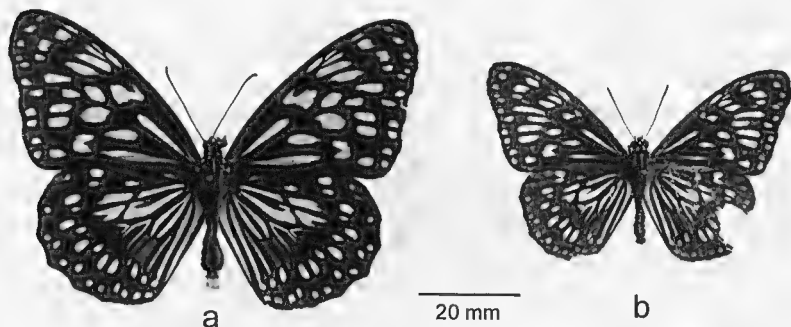


Fig. 1. Comparison of (a) average sized (fw = 47 mm) and (b) extreme dwarf (fw = 33 mm) of *Tirumala hamata*. The latter shows unusual signs of birdstrike.

The wing measurements were compared with those figured by Braby (2000), generally considered to represent average sizes for respective species. Results for males are shown in Table 1. Females were fewer in the sample but showed similar trends. Sample means were significantly smaller (exact probability,  $p < 0.01$ ) than the parametric average based on Braby (2000), mainly as a result of unusual numbers of very small individuals.

Table 1. Forwing length (fw) statistics for species sampled compared with 'parametric' measurements calculated from Braby (2000).

Species	number sampled	mean fw ±standard deviation	minimum fw length	average fw, from Braby (2000)
<i>Papilio aegaeus</i>	16	49.5 ±4.6 mm	43 mm	55 mm
<i>Tirumala hamata</i>	30	41.8 ±3.5 mm	33 mm	47 mm
<i>Hypolimnys bolina</i>	12	39.4 ±3.1 mm	35 mm	44 mm

The effect was most strongly marked in *T. hamata* which showed a particularly wide spread of sizes (Fig. 2). The size distribution is clearly skewed to the right, with a long tail of representing a few very small individuals. These may have arisen from starvation or malnutrition as host plants became depleted, following population explosions earlier in the year after the first of a series of protracted rainy spells. Several cases of defoliation of small *Citrus* plants in the garden by *P. aegaeus* larva supported this hypothesis. By contrast, *Euploea core* (Cramer, 1780), which was also very abundant, showed no such obvious trend during the sampling period, but the following week it was notable that most individuals of this species, and also those of *E. tulliolus* (Fabricius, 1793) were also small.

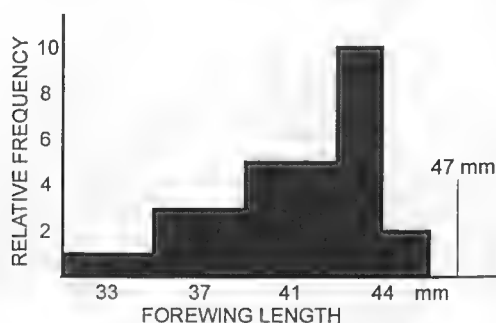


Fig. 2. Frequency distribution of forewing length in male *Tirumala hamata* sampled.

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# **IMBER, A NEW GENUS FOR THE AUSTRALIAN HAWK MOTH *LANGIA TROPICUS* MOULDS, 1983 (LEPIDOPTERA: SPHINGIDAE)**

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## **Abstract**

A new genus, *Imber*, is erected for the Australian hawk moth *Langia tropicus* based on differences in adult, larval and pupal morphology. Differences from the genus *Langia* are documented. Most notable differences include the shapes of the male uncus and gnathos, the arrangement of larval tubercles, the shape of the larval head and the shape of the pupa.

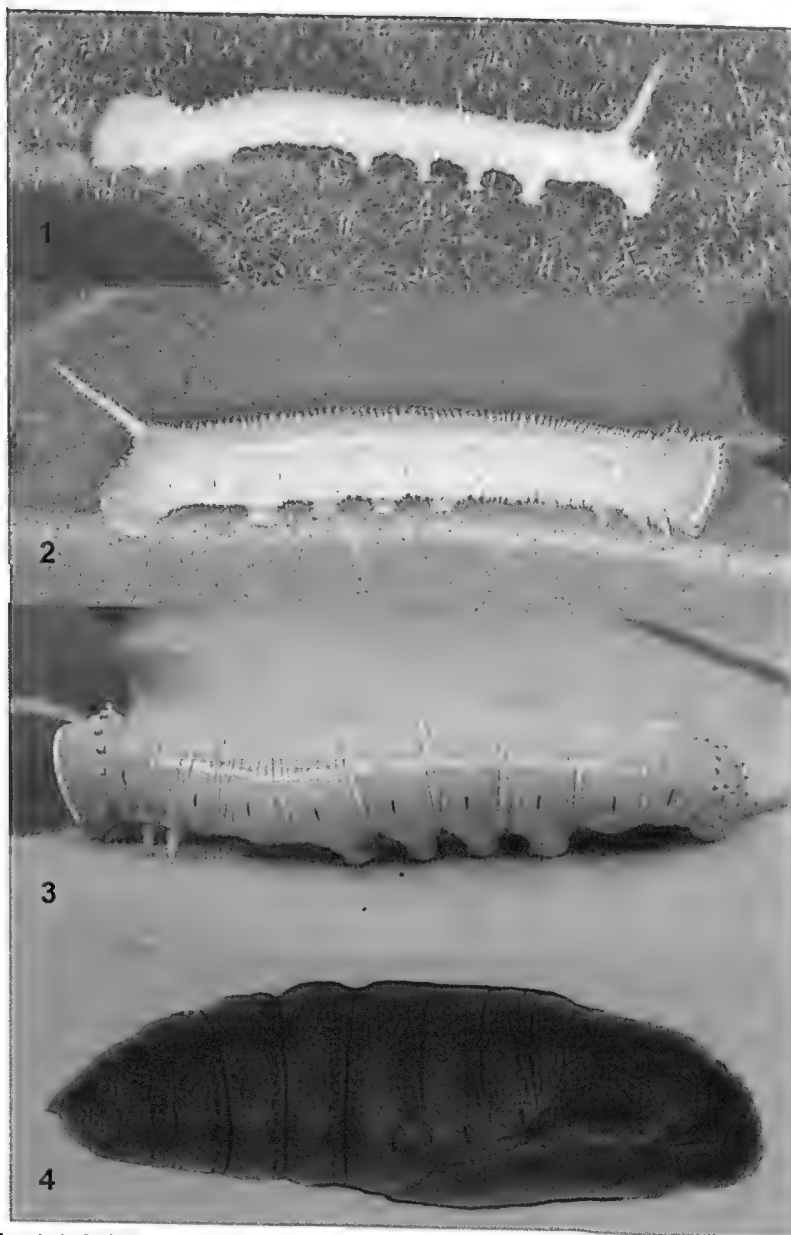
## **Introduction**

When *Langia tropicus* Moulds, 1983 was originally described from Australia, nothing was known about its life history. At that time, the general appearance of the adult, with its brownish tones and scalloped outer forewing margins, suggested that it belonged in the genus *Langia* Moore, 1872. Nevertheless, Moulds (1983) noted differences in size, forewing and thoracic maculation, and male genitalia relative to other *Langia* species.

The genus *Langia* was erected to accommodate *L. zenzeroides* Moore, 1872 and *L. khasiana* Moore, 1872 (Moore, 1872). Subsequently, *L. khasiana* was synonymised with *L. zenzeroides*. Currently the nominotypic race of *L. zenzeroides* and two additional subspecies, *L. z. formosana* Clark, 1936 and *L. z. nawai* Rothschild & Jordan, 1903, are recognized from across the Oriental region (Kitching & Cadiou, 2000). Rothschild & Jordan (1903) provided brief descriptions of the larva and pupa of *L. zenzeroides*.

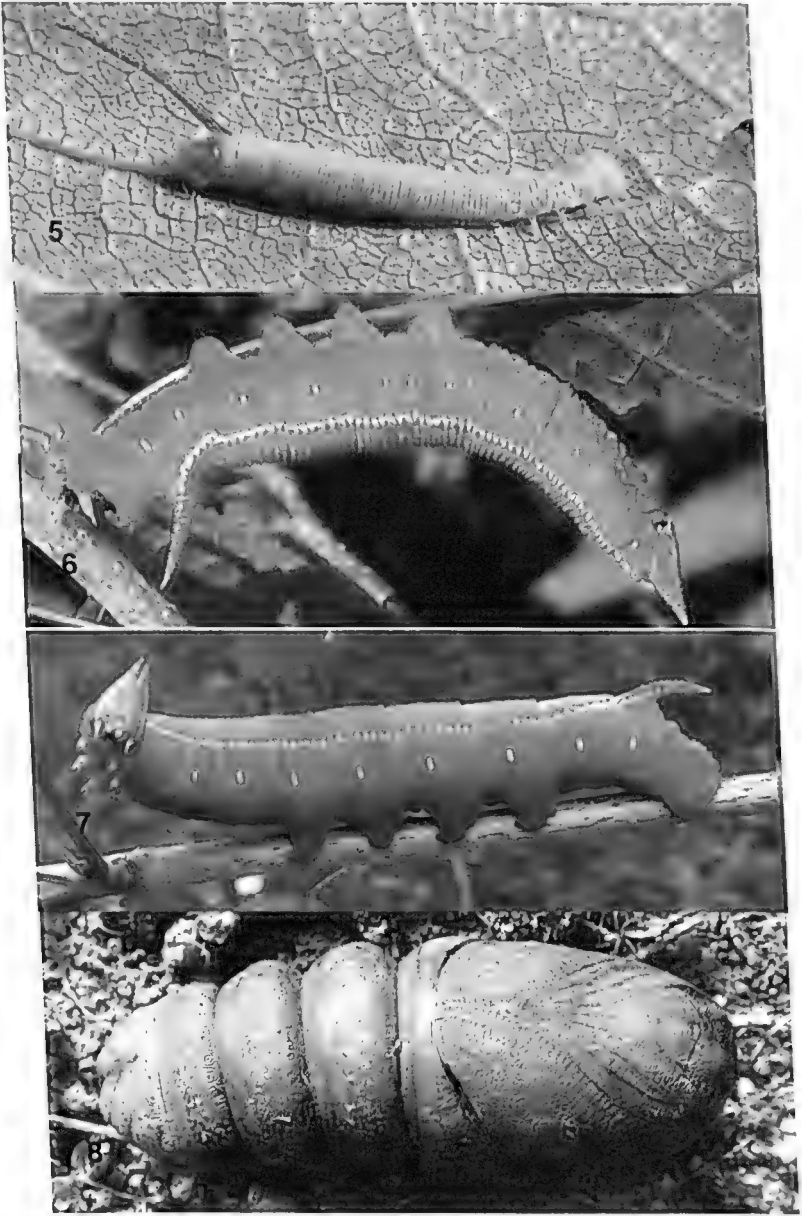
The recent discovery of the life history of *tropicus* and description of the immature stages by Lane & Moulds (2010) gave us cause to reconsider the generic placement of *tropicus*. Jean Haxaire of Laplume, France, provided the authors with a series of quality digital images of all immature stages of *zenzeroides* to compare with the immature stages of *tropicus*. The morphological differences between the larvae and pupae of *tropicus* and *zenzeroides* are profound. These differences indicate that *tropicus* and *zenzeroides* are not congeneric and that generalized adult similarities are simply the result of convergence.

Below we erect the monotypic genus *Imber* gen. n. to accommodate *tropicus* and discuss the differences in larval, pupal and adult morphology between it and *Langia*.



**Figs 1-4.** *Imber tropicus* (Moulds, 1983): (1) first instar larva (photo M. Moulds); (2) fourth instar larva (photo David Lane); (3) fifth instar larva showing the rounded head, large tubercles on prothoracic shield, stumpy caudal horn and large tubercles on anal plate (photo David Lane); (4) pupa, lateral view (photo M. Moulds).





**Figs 5-8.** *Langia zenzeroides* Moore, 1872: (5) first instar larva; (6) fourth instar larva; (7) fifth instar larva showing the conical head turned front on to camera and the well-developed caudal horn; (8) pupa, ventral view. Photos Jean Haxaire.

**Tribe Smerinthini**  
**Genus *Imber* gen. n.**

Type species: *Langia tropicus* Moulds, 1983, here designated.

Included species: *tropicus* (Moulds, 1983), **comb. n.**

Etymology: From the Latin *imber* meaning rain, a storm, or pelting rain, and referring to the appearance of adults and larvae following the first big rains of the wet season; masculine.

**Diagnosis**

*Male*: Scales on head and body narrow, erect on head, semi-prostrate on body, densely packed giving a furry appearance. Eyes bare, unlashd. Antennae tapering to a pointed apex; apical segment a little shorter than preceding two combined, scaled dorsally; not reaching apex of fore wing cell; ventrally compressed laterally and tending keel-shaped, cilia well developed. Labial palps densely scaled but lacking microtrichia on inner surface of segment 1; segment 2 not abnormally swollen. Piliifer with a dense tuft of long bristles apically. Base of proboscis concealed. Fore leg epiphysis long, slender and spine-like, tarsal combs present on all segments, doubling of external row of basitarsal spines on outer face; mid and hind tarsi without combs; mid and hind tibial spurs without combs; outer apical hind tibial spur much less than half the length of hind basitarsus and a little longer than inner apical spur; pulvillus present, well developed; paronychium slender and spine-like, bilobed with the upper lobe longest. Fore wing termen scalloped for its full length but with the penultimate indentation always shallow, apex not produced. Abdomen with small tufts of scales sublaterally on abdominal tergites most pronounced on segments 5-7; apex not broadly tufted but with small ventral scale tufts. Genitalia with uncus and gnathos tending tubular, curved, widely opposed and together pincer-like; stridulatory scales on valve lacking; aedeagus lacking cluster of small spines near apex.

*Female*. Similar to male but lacking the apical ventral scale tufts.

*Larva* (Figs 1-3)

First instar with prothoracic shield bearing a prominent transverse row of evenly spaced tubercles across its width; a submedial pair of prominent primary tubercles on anal plate; caudal horn slender and either straight or slightly curved forwards. Second to fourth instars with head rounded in shape, lying flat against prothorax and also bearing a pair of conical tubercles on the anterior vertex one either side of the coronal suture and larger than any other tubercles on head; tubercles on the prothoracic shield similar to those of first instar. Instars 1-4 all heavily stippled with numerous small white tubercles. Last instar larva (fifth instar) with head rounded and lying flat against prothorax as in earlier instars but the large, conical tubercles on the vertex of earlier instars are lost; body smooth in appearance without the

small, white tubercles of earlier instars; caudal horn greatly reduced to little more than a smooth, pointed knob; tubercles on anal plate all more or less similar in size.

#### *Pupa* (Fig. 4)

Glossy; stout and thick-set in overall shape; proboscis more or less confluent with the profile of head and body and not developed into a keel shape; metathoracic spiracle not concealed; traction ridges absent; cremaster terminating in a simple tubular projection.

#### **Distinguishing features**

Adults of *Imber* gen. n. differ from the superficially similar genus *Langia* in having the fore legs slender with a slender spine-like epiphysis rather than being robust and thick-set with a broad epiphysis as in *Langia*; and the fore wing termen is scalloped for its full length rather than reducing and fading out on distal third or so as in *Langia*. The male genitalia show significant differences [compare figs of *tropicus* in Moulds (1983) with those of *L. zenzeroides* in Bell and Scott (1937)]. The uncus and gnathos of *Imber* are almost tubular structures, positioned widely, bifid and pincer-like, whereas the uncus of *Langia* is essentially flat and the gnathos reduced to a pair of finger-like structures.

Larvae through the first four instars of both genera are heavily stippled with very small, white, tubercles giving the body surface a rough, granulated appearance (Figs 1, 2, 5, 6). Apart from this character larvae of *Imber* and *Langia* are quite different morphologically. The 1<sup>st</sup> instar larva of *Imber* (Fig. 1) has a submedial pair of prominent tubercles on the anal plate which are lacking in *Langia* (Fig. 5). Further, the caudal horn of *Imber* is sturdy and straight or slightly curved forwards, whereas that of 1<sup>st</sup> instar *Langia* larva is finer, nearly twice as long, and curves to the rear. Additionally, the 1<sup>st</sup> instar larva of *Imber* has a prominent transverse row of evenly spaced tubercles across the prothoracic shield that persist throughout its development, an attribute lacking in *Langia*.

While differences in the 1<sup>st</sup> instar larva are significant, characters in the remaining instars confirm the proposed generic placement. In the 2<sup>nd</sup> to 4<sup>th</sup> instars of *Imber*, the head is rounded, lies flat against the prothorax, and bears a pair of elongate conical tubercles on the anterior vertex, one either side of the coronal suture (Fig 2). In addition, the tubercles on the prothoracic shield of *Imber* remain as described in the 1<sup>st</sup> instar. In marked contrast, in the 2<sup>nd</sup> to 5<sup>th</sup> instars of *Langia*, the head is pitched decidedly forward with the apex ending in an exaggeratedly bisected point (Figs 6, 7). In the last instar (5<sup>th</sup>), the head of *Imber* remains rounded and continues to lie flat against the prothorax but the elongate conical tubercles on the vertex are lost (Fig. 3). The stippling of small, white tubercles is also lost giving the larva a very smooth appearance. In addition, the caudal horn is greatly reduced to little

more than a smooth, pointed, conical knob, and the anal plate is covered with smooth, conical tubercles of near equal size.

The pupal distinctions between *Imber* and *Langia* are nearly as dramatic as those of the larva. The pupa of *Imber* is smooth, glossy, and has a well-defined, heavily sclerotized cremaster with a distal linear projection (Fig. 4). In contrast, the pupa of *Langia* is slightly rough, dull, more robust and stout, with exaggeratedly rotund abdominal segments, and has a very small, rudimentary cremaster (Fig. 8).

### Distribution

The single included species is endemic to Australia. It occurs widely across the monsoonal north of the continent from Broome in Western Australia (Hill, Marshall and Moulds, pers comm.) to north-eastern Queensland (Lane and Moulds, 2010).

### Discussion

Adult morphology provides only weak guidance for tribal placement of *Imber*. The rounded larval head of *Imber* suggests placement in the Sphingulini although the dorsal projections on the head of earlier instars if interpreted as remnants of a conical head would suggest Smerinthini. The deep pits anterior of the spiracles in the pupa are indicative of a relationship with Smerinthini genera such as *Polytychus* (I. Kitching, pers. comm.). We tenuously place *Imber* in the tribe Smerinthini where the adult and pupa seem most compatible with the genera currently placed there.

### Acknowledgements

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